

# CALIFORNIA STATE DEPARTMENT OF PUBLIC HEALTH

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BERTRAM P. BROWN, M.D., Director

## Weekly Bulletin



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GUY P. JONES  
EDITOR

## Medical and Public Health Aspects of Trichinosis

Abstract of "The medical and public health aspects of trichinosis" by Willard H. Wright and Frederick J. Brady, National Institute of Health, U. S. P. H. S.

Trichinosis is a disease caused by the small round worm parasite, *Trichinella spiralis*. The mature worms inhabit the small intestine and the infective larvae inhabit the voluntary muscles. The adult female worm is from 3 to 4 mm. in length; the male 1.4 to 1.6 mm. in length; and the infective larva is about 1 mm. in length. The parasite is found in many carnivorous and omnivorous warm-blooded animals with the exception of birds. Man usually acquires an infection through the consumption of raw or undercooked trichinous pork.

### Life History

When trichinous meat is eaten, the larvae are freed from their cysts by the action of gastric juice. Upon reaching the small intestine the sexes develop to maturity within 72 hours and mate. About 6 or 7 days after infection the female worms give birth to living young. This production of larvae may continue for 6 or more weeks.

The young worms, which are about 0.1 mm. long, enter the lymph spaces and through the lymph system they attain the venous circulation. After passing through the heart and reaching the arterial circulation they are carried to all or nearly all of the voluntary muscles of the body. These worms are most numerous in the blood stream from the 8th to the

25th day after infection. They are difficult to find in the muscles before the 15th day after infection. These larvae may reach the infective stage as early as the 21st day after infection after which time the cyst wall is formed. Calcification of the cyst wall may begin in 8 to 10 months. After several years the larvae degenerate and die.

### Incidence of Infection

During the past several years increasing interest has been shown in surveys designed to ascertain the incidence of trichinae in persons coming to necropsy in various parts of the United States. In the National Institute of Health a total of 4,893 diaphragms have been examined from persons dying in hospitals in 35 states (including California) and the District of Columbia. Examinations by other laboratories have totaled 5,531. At this writing 10,424 examinations have been made, of which 1,547, or 14.8 per cent, were positive for the parasite. This represents actual findings without reference to a correction figure for such variables as the method of examination, the muscle or muscles sampled or the population groups represented.

In the National Institute of Health examinations, counts were made of the number of parasites per gram of tissue. Most of the positive cases represented relatively light infections but approximately 2.5 per cent of the positives or 0.4 per cent of the total number had infections which undoubtedly were

sufficient to produce clinical symptoms of disease. While necropsy findings can not be interpreted exactly in the light of clinical trichinosis, the findings would seem to indicate that the disease is more extensive and occurs more frequently than is evidenced by morbidity reports.

### Symptomatology

Trichinae may infect any system of the body with the possible exception of the reproductive system. Thus, the symptoms are very diverse. Likewise, the intensity of infection is extremely variable so that all gradations of symptoms from the mild, almost sub-clinical syndrome to the severe fatal infection may be found. It is thus understandable why all cases are not recognized and why the symptoms are confused with those of more than 50 other diseases.

Within 24 to 48 hours after the ingestion of trichinous meat the first symptoms may occur, being manifested by nausea, vomiting and diarrhea. In cases which do not show these symptoms, an irregular but persistent fever may be the first sign of infection. This may be followed by a persistent edema of the face which is most apparent in the suborbital tissue and appears about the 9th or 10th day of illness. Edema of the dependent portions may occur later in the course of the disease.

Muscle tenderness and soreness are frequently present, pain being experienced mostly on movement of the muscles. This may be most pronounced in the larger muscles, but mastication and deglutition may be painful and there may be a marked involvement of the diaphragm and intercostal muscles leading to respiratory difficulties. The tenderness and pain usually reach their height 4 to 6 weeks after onset and may not completely subside until a year or two after acute illness.

Petechiae and ecchymoses may occur subcutaneously in various parts of the body. There may be an annoying pruritis with or without skin lesions.

Myocardial damage of a temporary nature may occur due to the passage of large numbers of larvae through the heart muscle. Involvement of the central nervous system is not infrequent. The passage of the larvae through the lungs may result in severe congestion which may be followed by bronchopneumonia with a fatal termination during the 6th to 8th week of illness.

The acute phase of the disease usually subsides in about 6 to 8 weeks. However, symptoms of muscle pain and tenderness and inordinate fatigue may incapacitate the patient for months and persist for a year or more.

### Diagnosis

The information afforded by the symptomatology should be supplemented by the employment of several other diagnostic methods which are available.

*The blood picture.* A leucocytosis ranging from 10,000 to 20,000 is common. Leucopenia is occasionally present. An eosinophilia is of significance, usually making its appearance on the 7th or 8th day after infection.

*Examination for larvae.* Examination of blood, spinal fluid and feces for trichinae larvae is of significance only if the larvae are found. The failure to find larvae does not eliminate trichinosis. A muscle biopsy, if positive, affords definite proof of infection. It should not be made before the 21st day after infection. Histological examination of the muscle is not as satisfactory a method as compressing the muscle between plate glass slides and looking for the larvae with a low power of the microscope. If no larvae are found the muscle should then be digested with artificial gastric juice and the sediment examined for larvae. It should be remembered that larvae that are less than 18 days old will be digested in this process, so that negative findings should not rule out a diagnosis of trichinosis.

*Intradermal and precipitin tests.* These tests have been developed and refined to the point that they are now valuable diagnostic aids. The antigen prepared by the National Institute of Health gives no reaction in patients harboring the common intestinal worms. However, when the tests are made it should be borne in mind that necropsy studies indicate that one in every six persons in the United States is infected with the trichinae. Thus it may be expected that some individuals may react due to a past infection etiologically unrelated to current illness. In interpreting the results of the test it should be remembered that the skin may not become sensitive until after the second week of infection. Occasionally, a delayed reaction instead of the usual reaction within 15 to 20 minutes may occur.

The precipitin test elicits a response later than the skin test, usually not until after the third week of infection. However, precipitins do not remain in the blood stream as long as the skin remains sensitive and therefore the test is of value in eliminating an infection which may be unrelated to the present clinical condition of the patient. When possible, the use of both tests is advisable.

Since a clear serum is necessary for performing the precipitin test, the following directions are given:

1. Serum for the precipitin test should be secured either before or 24 hours after the application of the intradermal test.

2. The patient should be bled before breakfast in order to avoid chylous specimens and to prevent deterioration of the sample en route.

3. All apparatus used for collecting specimens should be washed free of alkali and acid before sterilization.

4. Only sterile apparatus should be used.

5. The syringe used in drawing blood should be rinsed with physiological saline solution to prevent hemolysis.

6. The serum should be separated from the clot before hemolysis begins to take place, and rendered perfectly free from red cells and particles by centrifuging.

7. At least 2 cc. of perfectly clear serum should be submitted; about 5 cc. of blood will provide this amount of serum.

8. Do not heat or add preservative of any nature.

#### Treatment

There is no specific drug treatment available. Supportive measures are of value and should be directed toward conserving the patient's strength. Rest in bed, the use of a liquid or semi-soft diet rich in carbohydrates, and good nursing are indicated.

#### Sources of Infection in Swine

The incidence of the parasite and the sources of infection in swine are of interest from the standpoint of preventive medicine since most cases of trichinosis are acquired by consumption of uncooked or insufficiently cooked trichinous pork. Reports in the literature indicate that hogs fed on garbage as collected are the most heavily infected with trichinae and hogs fed on cooked garbage show a lower incidence of infection than those fed chiefly on grain. This would indicate that the rat plays only a minor role in transmitting the infection to hogs. Thus, it would appear that the hog fed on uncooked garbage is the chief source of human trichinosis.

From the public health standpoint it is of interest to note that 52.7 per cent of 764 cities of the United States having a population of 10,000 or more are disposing of their garbage in whole or in part by feeding it to hogs. In only 24 of these cities was all or a part of the garbage cooked.

#### Prevention and Control

Control of trichinosis at the present time rests entirely in the hands of the consumer through thor-

ough cooking, and in the meat inspection services controlling the type of pork eaten by the consumer without further cooking. (Salami, etc.)

It is stated that the control of feeding raw garbage to hogs appears to be the most feasible method of controlling trichinosis at the present time. Since approximately 10 per cent of the hogs marketed yearly in the United States are raised on raw garbage, the elimination of this practice would remove a relatively large number of trichinous hogs from the market and would decrease opportunities for infection to even a greater degree because of the relatively heavier infections in hogs maintained on this type of feed.

#### TULARE HAS NEW HEALTH OFFICER

Dr. Albert E. Raitt has been appointed Health Officer of Tulare County to succeed Dr. Ellis Sox who is now Assistant Chief of the Bureau of Local Health Work of the California State Department of Public Health.

#### CHANGES AMONG HEALTH OFFICERS

Dr. John H. Pasek of Bridgeport has been appointed Health Officer of Mono County to succeed Dr. William M. Russell who has entered military service.

Dr. Lionel W. Sorenson is now City Health Officer of Corcoran having succeeded Dr. Frederick A. Knight.

Following the death of Dr. James H. Barr, who had been City Health Officer of Yuba City for a long period of years, the city transferred its public health administration to the Yuba-Sutter Bi-County Unit.

"Health inspections can only be adequate if done daily and in the school we have one, and only one agent who is present on the 200, 400, 600, 800, or 1,000 days between visits by the school physician, and who, if at all interested in the child, should 'be able to recognize the child's usual appearance and action and to note any departure therefrom.' In any school system which is really concerned with the health of the child, the teacher will refer any pupil who deviates from the usual (the word normal might as well be abandoned) to the school physician even if he has examined that child routinely on the previous day. If the teacher has been adequately prepared in the training school or by the school physician, she will make all the better interim examiner."—Frequency of Periodic Health Examinations, by James Frederick Rogers, M.D., Dr. P.H. U. S. Office of Education, Federal Security Agency, Washington, D. C.

## MORBIDITY

Complete Reports for Following Diseases for Week Ending  
February 8, 1941

## Chickenpox

826 cases: Alameda County 5, Alameda 3, Berkeley 13, Oakland 26, San Leandro 1, Amador County 1, Colusa County 1, Antioch 5, Pittsburg 1, Fresno County 4, Fresno 1, Sanger 2, Glenn County 2, El Centro 1, Imperial 1, Kern County 15, Bakersfield 8, Lemoore 4, Lake County 4, Los Angeles County 54, Alhambra 2, Avalon 1, Burbank 6, Compton 3, El Segundo 4, Glendale 4, Hermosa 11, Huntington Park 2, Inglewood 4, Long Beach 8, Los Angeles 79, Pasadena 10, San Fernando 4, San Marino 2, Santa Monica 9, Sierra Madre 1, Whittier 8, Lynwood 1, South Gate 7, Maywood 2, Madera County 6, Madera 1, Chowchilla 1, Marin County 4, Merced County 8, Gustine 1, Merced 3, Monterey County 6, King City 4, Orange County 9, Anaheim 4, Fullerton 8, Santa Ana 28, La Habra 3, Tustin 5, Riverside County 8, Riverside 8, Palm Springs 1, Sacramento County 1, Sacramento 38, San Bernardino County 9, Needles 2, Ontario 15, San Diego County 15, Coronado 1, Escondido 1, San Diego 34, San Francisco 88, San Joaquin County 29, Lodi 5, Stockton 9, San Luis Obispo County 1, Paso Robles 9, San Mateo County 2, Burlingame 3, San Bruno 2, San Mateo 1, Menlo Park 1, Santa Barbara County 4, Santa Barbara 5, Santa Maria 8, Santa Clara County 3, Palo Alto 11, San Jose 3, Sunnyvale 2, Santa Cruz 1, Shasta County 3, Siskiyou County 10, Yreka 18, Solano County 1, Benicia 6, Vallejo 1, Sonoma County 4, Petaluma 1, Santa Rosa 4, Stanislaus County 8, Modesto 2, Sutter County 8, Tulare County 9, Exeter 4, Visalia 2, Ventura County 2, Fillmore 1, Yolo County 3, Woodland 6, Marysville 2.

## Diphtheria

25 cases: Oakland 1, Butte County 7, Los Angeles County 1, Long Beach 1, Los Angeles 2, Riverside 1, Sacramento 6, San Francisco 2, San Joaquin County 1, Sonoma County 1, Tulare County 1, Santa Paula 1.

## German Measles

173 cases: Alameda County 6, Alameda 2, Berkeley 7, Livermore 6, Oakland 4, Lassen County 1, Susanville 15, Los Angeles County 3, Glendale 2, Long Beach 22, Los Angeles 5, Pasadena 1, Bell 2, Monterey County 1, Monterey 1, Orange County 2, Anaheim 1, Laguna Beach 1, Tustin 3, Redlands 1, San Diego County 9, Coronado 3, El Cajon 1, Escondido 2, National City 3, San Diego 33, San Francisco 5, Stockton 1, San Luis Obispo County 1, San Luis Obispo 1, Redwood City 1, Santa Clara County 12, Palo Alto 1, Shasta County 1, Vallejo 2, Sonoma County 1, California 1.\*

## Influenza

1676 cases: Alameda 1, Berkeley 10, Oakland 3, Contra Costa County 2, Coalinga 1, Kern County 288, Bakersfield 115, Los Angeles County 524, Alhambra 244, Claremont 1, Compton 2, Culver City 1, El Monte 5, Glendale 2, Inglewood 4, Long Beach 1, Los Angeles 120, Pasadena 4, San Marino 3, Santa Monica 3, Whittier 1, Hawthorne 1, Madera County 1, Monterey County 2, Orange County 2, Newport Beach 5, Orange 1, Santa Ana 2, Laguna Beach 5, Roseville 249, Sacramento County 1, Sacramento 9, San Bernardino County 1, San Diego 1, San Joaquin County 1, Lodi 2, Paso Robles 22, San Luis Obispo 1, Santa Barbara County 14, San Jose 4, Sonoma County 3, Petaluma 9, Corning 5. Mostly delayed reports.

## Measles

124 cases: Alameda 1, Hayward 1, Livermore 1, Oakland 4, Eureka 1, Kern County 9, Bakersfield 7, Los Angeles County 5, Alhambra 1, Los Angeles 13, Bell 1, Monterey 1, Salinas 1, San Diego County 2, Coronado 1, El Cajon 1, San Diego 4, San Francisco 3, San Luis Obispo County 1, San Luis Obispo 1, Santa Barbara County 2, Santa Clara County 2, San Jose 4, Santa Cruz 12, Solano County 1, Vacaville 1, Vallejo 1, Trinity County 2.

## Mumps

357 cases: Alameda County 3, Berkeley 1, Oakland 15, Butte County 4, Chico 1, Contra Costa County 1, Fresno 2, Inyo County 2, Kern County 18, Delano 2, Bakersfield 2, Taft 3, Los Angeles County 46, El Segundo 1, Glendale 9, Huntington Park 2, Inglewood 2, Long Beach 16, Los Angeles 31, Pasadena 1, Pomona 11, Santa Monica 1, South Pasadena 1, Whittier 1, South Gate 2, Monterey Park 3, Maywood 2, Bell 2, Orange County 10, Fullerton 1, Huntington Beach 13, Newport Beach 1, Santa Ana 5, La Habra 6, Riverside County 7, Elsinore 13, Riverside 1, San Jacinto 1, Indio 10, Sacramento 1, Chino 2, Ontario 1, El Cajon 1, La Mesa 2, San Diego 14, San Francisco 40, San Luis Obispo County 1, Santa Barbara County 2, San Jose 2, Santa Cruz County 2, Shasta County 2, Solano County 12, Sonoma County 2, Red Bluff 2, Tulare County 11, Visalia 1, Ventura County 4, Oxnard 1, Santa Paula 1.

## Pneumonia (Lobar)

59 cases: Alameda County 1, Alameda 1, Berkeley 3, Oakland 2, Los Angeles County 6, Compton 1, Glendale 1, La Verne 1, Los Angeles 9, Montebello 1, Torrance 1, Bell 1, Napa 1, Fullerton 1, Santa Ana 1, Laguna Beach 3, Riverside 1, Sacramento County 1, Sacramento 7, San Diego County 1, San Francisco 9, San Joaquin County 1, San Luis Obispo County 1, Sonoma County 2, Petaluma 1, Davis 1.

## Scarlet Fever

112 cases: Alameda 1, Oakland 3, Contra Costa County 1, Fresno County 2, Fresno 2, Sanger 3, Imperial 1, Bakersfield 1,

Los Angeles County 24, Alhambra 1, Beverly Hills 1, Compton 2, Huntington Park 1, La Verne 1, Long Beach 5, Los Angeles 11, Manhattan 1, Pasadena 5, Pomona 1, San Gabriel 1, Santa Monica 1, Whittier 1, Lynwood 1, Monterey Park 2, Orange County 1, Santa Ana 1, Lincoln 1, Palm Springs 1, Sacramento 2, Escondido 3, San Diego 5, San Francisco 6, San Joaquin County 3, Lodi 1, Daly City 1, San Mateo 1, Siskiyou County 1, Vacaville 1, Petaluma 2, Red Bluff 1, Trinity County 1, Tulare County 5, Ventura County 1, Santa Paula 1.

## Smallpox

No cases reported.

## Typhoid Fever

4 cases: Glendale 1, Los Angeles 1, Santa Clara County 1, California 1.\*

## Whooping Cough

451 cases: Alameda County 1, Alameda 10, Berkeley 22, Oakland 24, Butte County 3, Chico 1, Concord 5, Fresno County 5, Fresno 2, Glenn County 12, Kern County 4, Bakersfield 3, Lake County 8, Los Angeles County 43, Alhambra 1, Burbank 2, Compton 4, Glendale 2, Hermosa 3, Long Beach 19, Los Angeles 24, Manhattan 1, Pasadena 4, Pomona 2, Redondo 3, Santa Monica 7, Whittier 2, Lynwood 1, Hawthorne 4, South Gate 4, Monterey County 1, Salinas 3, Orange County 14, Anaheim 4, Huntington Beach 2, Orange 2, Santa Ana 8, Seal Beach 1, La Habra 1, Laguna Beach 1, Tustin 1, Lincoln 1, Riverside 1, Sacramento County 2, Sacramento 4, San Bernardino County 1, Chino 3, Redlands 1, San Bernardino 4, Chula Vista 5, San Diego 10, San Francisco 52, San Joaquin County 13, Lodi 3, Manteca 3, Stockton 2, San Luis Obispo County 2, Paso Robles 1, San Luis Obispo 6, San Mateo County 3, Santa Barbara County 18, Santa Clara County 3, San Jose 1, Santa Cruz County 3, Shasta County 6, Redding 1, Sonoma County 3, Tulare County 29, Ventura County 3, Fillmore 1, Oxnard 2.

## Meningitis (Epidemic)

3 cases: Madera 2, San Francisco 1.

## Dysentery (Amoebic)

4 cases: Azusa 1, Redondo 1, Ontario 2.

## Dysentery (Bacillary)

6 cases: Bishop 3, Bell 1, Sonoma County 2.

## Poliomyelitis

3 cases: San Diego County 1, Santa Clara County 2.

## Tetanus

One case: Riverside County

## Trachoma

2 cases: Mendocino County 1, Napa County 1.

## Paratyphoid Fever

One case: Los Angeles.

## Rabies (Human)

One case: Oxnard

## Trichinosis

One case: Oakland.

## Food Poisoning

5 cases: San Francisco.

## Undulant Fever

6 cases: Fresno County 1, Los Angeles 2, Monrovia 1, Plumas County 1, Riverside 1.

## Coccidioides Granuloma

One case: Kern County.

## Septic Sore Throat

2 cases: Lake County.

## Epilepsy

40 cases: Berkeley 1, Oakland 2, Los Angeles County 11, Alhambra 1, Long Beach 2, Los Angeles 11, Napa County 1, San Bernardino County 3, San Francisco 6, Stockton 1, San Mateo County 1.

## Rabies (Animal)

7 cases: El Cerrito 1, Los Angeles 1, Riverside 1, San Diego 4.

\* Cases charged to "California" represent patients ill before entering the State or those who contracted their illness traveling about the State throughout the incubation period of the disease. These cases are not chargeable to any one locality.

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